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UNITED KINGDOM

Patents ADP number *(if you know it)*

63877 65001

If the applicant is a corporate body, give the country/state of its incorporation

UNITED KINGDOM

4. Title of the invention

A CONTROL PEDAL ASSEMBLY

5. Name of your agent *(if you have one)*

NIGEL PAUL SANDERSON

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

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A CONTROL PEDAL ASSEMBLY

The present invention relates to an improved control pedal assembly, and in particular, an improved control pedal assembly for use by a driver for controlling a vehicle.

Background to the Invention

When a driver is riding in or on a vehicle, at least one control pedal is typically provided to allow him to control the speed of the vehicle. Such a control pedal may act to control a supply of combustible fuel to an internal combustion engine, or may serve to vary an amount of electrical power supplied to an electric motor. An example of such a control pedal is commonly referred to as an accelerator pedal.

To control the speed of his vehicle, the driver applies foot pressure to the accelerator pedal in order to displace the pedal to a position corresponding to a desired speed of the vehicle. Typically, for safety considerations, the control pedal is spring biased to a minimum speed (or even stationary) rest position, and the driver has to continuously apply force to the pedal to increase the vehicle's speed above the minimum speed. As the vehicle travels along, it is subjected to bumps and shocks due to unevenness of the road or other surface along which it is travelling. Some of these bumps and shocks are transmitted to the driver, and in particular to the driver's foot. This may cause the position of the

pedal to change, causing a variation in the speed of the vehicle, which accentuates the bumpiness of the ride. This is uncomfortable for the driver and any passengers, and may cause wear to the vehicle, or damage to any load being carried by the vehicle.

It is therefore necessary to provide a control pedal assembly which is able to resist variation in position of the pedal due to such bumps and shocks. Such a pedal assembly must, however, remain easy to operate. It should tend to keep the control pedal in a fixed position unless an intentional force is applied to change the position of the pedal, aiding the driver to keep a constant pedal position and so also a constant speed of the vehicle.

In the past, it has been common for accelerator pedals to operate by pulling on a cable which operates a control lever, for example on a carburettor of a petrol engined vehicle. Such cables are held in a sheath, and the cable and sheath interact to provide a resistance to movement. The mechanical resistance between the cable and sheath provide a minimum force which must be exceeded if the position of the accelerator pedal is to be changed.

For example, a driver applies a force to the accelerator pedal to determine the position of the pedal and so the speed of his vehicle. To further depress the pedal, the driver must exert a force of a first value, sufficient to overcome any spring loading in the pedal assembly, and the mechanical resistance of the cable and sheath. To raise the pedal, the driver must reduce the force applied

to the pedal to a second value, less than the spring loading by an amount at least equal to the mechanical resistance of the cable and sheath. By applying a force intermediate between the first and second values, the pedal will not move. This is advantageous since any bumps and shocks transmitted to the drivers foot will only affect the position of the control pedal if they cause the force applied to the pedal to be greater than the first value, or be less than the second value. Even if the force applied the pedal does lie outside the range defined by the first and second values, the effect of the bumps and shocks will be reduced by the mechanical resistance overcome in displacing the pedal.

More recently, there is a trend toward electrical or electronic control of the speed of vehicles, both electrically driven and combustion engine driven. In such vehicles, the control pedals typically operate a small position sensor, such as a potentiometer, Hall effect sensor or capacitive or inductive proximity sensor. Such sensors offer very little mechanical resistance to displacement. Accordingly, the equivalents to the first and second values discussed above, are very close together. Only a small increase in applied force above the spring bias will be sufficient to further displace the pedal, and only a small decrease in applied force below the spring bias will be sufficient to raise the pedal. Accordingly, bumps and shocks transmitted to the driver's foot in vehicles equipped with this type of control pedal have a much greater influence on the pedal position, and so the speed of the vehicle, and bumpiness

of the ride.

In order to avoid the problems experienced with electrical or electronic control pedals, a mechanical hysteresis is preferably provided within the control pedal assembly. That is, an applied force above a first certain value will further depress the pedal; an applied force below a second certain value will cause the pedal to rise; and an force of value intermediate between the first and second certain values will cause the pedal to remain in its current position.. Preferably, the hysteresis provided will be sufficient that reasonably foreseeable bumps and shocks transmitted to the driver's foot are insufficient to cause the applied force to vary enough to displace the control pedal from its current position.

Accordingly, as the vehicle travels along, some of the bumps and shocks may still be transmitted to the driver, and in particular to the driver's foot, but the position of the pedal should preferably not change, avoiding variation in the speed of the vehicle and reducing bumpiness of the ride.

A control pedal assembly incorporating a mechanical hysteresis mechanism is known, and is illustrated in Fig. 1. A control pedal arm 10 is linked to a rotor 12, and the pedal arm 10 and rotor 12 are arranged to rotate in unison about a pivot 14. A mounting bracket 16 carries pivot 14, and is provided with mounting holes 18 for mounting the control pedal assembly, using bolts for

example.

Mounting bracket 16 includes a chamber 20 having an arcuate inner surface 22, centred on the pivot 14. A spring 24 acts on an inner surface of chamber 20 and a sliding head 26 to bias the pedal arm 10 and rotor 12 into their rest position. A friction surface part 28 is provided, linked to rotor 12 such that it is free to move in a radial direction away from pivot 14. The friction surface part 28 is in contact with arcuate surface 22. Sliding head 26 is shaped so as to interact with formations 30 on rotor 12, so as to convert the spring bias of spring 24 into both a resilient bias of rotor 12 to its rest position (at the anti-clockwise extremity of cavity 20, as shown in the figure), and a radial bias urging friction surface part 28 into contact with arcuate surface 22. A position sensor may be mounted in cavity 20 using mounting means 32, 34. Alternatively, a position sensor may be mounted outside of the cavity 20, being mechanically linked to detect rotation of the pedal 10 and/or rotor 12 about the axis 14.

The control pedal assembly of the prior art suffers from the following drawbacks. Firstly, the pedal control unit is large, requiring considerable free space above the pivot 14. Disassembly of the control pedal assembly is necessary if the position sensor needs to be changed. In addition, the control pedal assembly of the prior art is not suitable for use with moulded plastic control pedals. There is currently a trend towards plastic pedals, as these may be made cheaply in larger quantities than the

welded steel pedals typically used in the prior art. Safety features such as break lines may easily be built into plastic pedals, which is more difficult with welded steel pedals.

Summary of the Invention

The invention provides an improved control pedal assembly. Preferably, the improved control pedal assembly has reduced size, requiring less free space above the pivot. Preferably, the position sensor can be changed without disassembly of the control pedal assembly. In addition, the control pedal assembly of the invention should preferably be suitable for use with moulded plastic control pedals.

More particularly, the invention provides a control pedal assembly including a frictional hysteresis providing part, which comprises a first friction surface mechanically linked to a control pedal arm; a second friction surface mechanically linked to a mounting bracket of the control pedal assembly; a pivotally mounted friction surface member carrying one of the friction surfaces; and a resilient member pivotally biasing the friction surface member about an axis, so as to resiliently bias the first and second friction surfaces into mutual contact.

The friction surface member preferably comprises a pivotally mountable cross piece; at least one arm piece carrying a corresponding friction surface and extending

in a direction perpendicular to the general plane of the cross piece, the friction surface member being pivotally mounted about an axis substantially perpendicular to the direction of the arm(s).

The pivotal axis of the friction surface member may also be substantially perpendicular to a plane of displacement of the control pedal arm.

The friction surface member is preferably mechanically linked at its axis to the control pedal arm.

The resilient member may act upon the control pedal arm through the friction surface member, and through its axis, to urge the pedal into a rest position.

The pivotal bias applied by the resilient member preferably increases with the depression of the pedal control arm.

Preferably, each of first and second friction surfaces comprises a pair of substantially arcuate surfaces, centred on an axis of rotation of the control pedal arm, each pair of substantially arcuate surfaces being located one on either side of the resilient member.

The first and second friction surfaces are preferably arranged to remain biased into mutual contact throughout a range of travel of the pedal control arm.

The friction surface member may be integrally formed with

the associated friction surface, as a plastic moulding. The first friction surface may be integrally formed with the control pedal arm, as a plastic moulding. The second friction surface may be integrally formed with the mounting bracket, as a plastic moulding.

At least one of the friction surfaces may be constructed of glass filled nylon. At least one of the friction surfaces may be constructed of rubber-and-talc-modified polypropylene copolymer.

The present invention also provides the use of a rubber-and-talc-modified polypropylene copolymer as a friction surface in a control pedal assembly, such as a control pedal assembly as described.

The present invention also provides a component carrying a friction surface, for use in a control pedal assembly, the friction surface being composed of a rubber-and-talc-modified polypropylene copolymer.

The present invention also provides a control pedal assembly comprising at least one friction surface constructed of a rubber-and-talc-modified polypropylene copolymer.

The rubber-and-talc-modified polypropylene copolymer may contain 10-40% talc, by weight. The rubber-and-talc-modified polypropylene copolymer preferably contains 20-30% talc, by weight.

Brief Description of the Drawings

Certain objects, characteristics and advantages of the present invention will become apparent from the following detailed description of certain embodiments of the invention, given by way of examples only, with reference to the accompanying drawings in which:

Fig. 1 shows a control pedal assembly of the prior art;
Fig. 2 shows a partially cutaway view of a control pedal assembly according to the present invention;
Fig. 3 shows a cross section of a hysteresis part in a pedal assembly according to the present invention, in a rest position;
Fig. 4 shows a cross section of a hysteresis part in a pedal assembly according to the present invention, in a depressed position;
Figs. 5A and 5B show views of a friction surface member of a control pedal assembly of the present invention;
Figs. 6A and 6B show views of a mounting bracket of a control pedal assembly of the present invention; and
Fig. 7 shows a partial view of the rear of the control pedal assembly, showing the operation of the frictional hysteresis providing part.

Detailed Description of the Invention

Fig. 2 shows a partially cutaway view of a control pedal assembly of the present invention. According to the present invention, a control pedal assembly 40 includes a frictional hysteresis providing part 50. The frictional

hysteresis providing part comprises a first friction surface 52 mechanically linked to a control pedal arm 60. A second friction surface 54 is mechanically linked to a mounting bracket 70 of the control pedal assembly. First and second friction surfaces are each carried on a respective component carrying a friction surface.

A pivotally mounted friction surface member 56 carries the first friction surface 52. The friction surface member 56 is a component carrying a friction surface. A resilient member 58 pivotally biases the friction surface member about an axis A, so as to resiliently bias the first and second friction surfaces into mutual contact. In the illustrated embodiment the resilient member is a coil spring but could be any resilient member. Preferably, resilient member 58 comprises two concentric coil springs, having strengths in the ratio 70:30.

A break line 62 may be provided in the pedal control arm 60. In the event of a collision, such a pedal control arm is designed to fracture along the break line, so as to protect the leg of the driver.

In the example illustrated, the pivotally mounted friction surface member 56 is mechanically attached to the pedal 60. In a possible alternative embodiment, a pivotally mounted friction surface member may carry the second friction surface and be mechanically attached to the mounting bracket 70.

A position sensor means 80 is provided, mechanically

linked to the mounting bracket 70, and connected such that a sensing portion of the sensor means is displaced in accordance with displacement of the pedal 60. In the illustrated embodiment, the sensor means is received into a recess in the mounting bracket 70. Preferably, an axis of rotation B of the pedal 60 passes through the sensor means, and a sensing portion of the sensing means is actuated by rotation about the axis B. In a simple form, the sensing means 80 may comprise a rotary potentiometer, whose moveable contact is rotated about the axis B by the displacement of the pedal. Alternative sensor means which could be used in the control pedal assembly of the invention include a Hall effect sensor, used to detect the proximity of a magnet, connected on an arm, rotatable about the axis B by displacement of the pedal 60. The sensor means could include capacitive or inductive proximity sensor means, or a rotary variable capacitor or inductor, or a rotatable slotted disc in combination with a suitable sensor.

Figs. 3 and 4 show partial cross sections of the control pedal assembly of Fig. 2, corresponding to the cutaway portion represented in Fig. 2. The frictional hysteresis providing part 50 is particularly illustrated, and the control pedal assembly is shown in rest and depressed positions, respectively. The resilient member 58 is illustrated in cross-section. It comprises a first spring 58a and a second spring 58b. The first and second springs are concentric coil springs, and may have strengths in the ratio 70:30.

Referring to Fig. 3, resilient member 58 urges pedal control arm into the rest position (illustrated) by action on the pivotally mounted friction surface member 56. Although friction surface member 56 is only pivotally connected to control pedal arm 60, about axis A, it is prevented from rotating by first friction surface 52 of the friction surface member 56 which bears upon the second friction surface 54 of the mounting bracket 70 at contact region 59. The mounting bracket 70 is a component carrying a friction surface. The urging force of springs 58a, 58b is therefore applied through axis A to urge the pedal control arm 60 to rotate about its axis B into its rest position, defined by a mechanical stop 64.

As illustrated in Fig. 3, the springs 58a, 58b, urge the friction surface member 56 to rotate in a clockwise direction. Friction surface member 56 is prevented from rotating by first friction surface 52 of the friction surface member 56 which bears upon the second friction surface 54 of the mounting bracket 70 at contact region 59. Friction surfaces 52, 54 are therefore urged together in contact region 59 with a force which depends on the force provided by springs 58a, 58b. The friction surfaces are constructed of a suitable material to provide friction to resist motion of the control pedal arm 60 - that is, to resist sliding motion of one friction surface over the other. Each component carrying a friction surface is preferably integrally formed of the material of the associated friction surface.

Preferably, as much of the pedal assembly as possible is constructed from plastics materials, as they are light, and can easily be moulded into required functional and aesthetic shapes. No surface treatment is required, and plastics materials may be very resistant to corrosion and atmospheric conditions.

The material chosen for friction surface member 56 must be strong enough to bear the force exerted by springs 58a, 58b; must be durable enough to withstand repeated operation of the control pedal assembly over a long period of time; must withstand sliding contact with the second friction surface 54; and should resist wear of the first friction surface. The second friction surface is preferably formed as an integral part of the mounting bracket 70, for ease of assembly. The material used should possess properties similar to those discussed with reference to the friction surface member, but must also be suitable for providing mechanical mounting for the control pedal assembly and provide wear-resistant pivot points for axes A and B.

A suitable material for the mounting bracket 70, which preferably includes the second friction surface, is a glass filled nylon.

The friction surface member 56, which preferably includes the first friction surface, may also be of a glass filled nylon material. However, use of glass filled nylon for both friction surfaces may lead to noisy operation of the pedal assembly. An alternative material for the friction

surface member may be PBT (polybutylene teraphthalate), or a rubber-and-talc-modified polypropylene copolymer. In the rubber-and-talc-modified polypropylene copolymer, the talc acts as a filler and stiffener. The talc should represent 10-40% by weight, preferably 20-30%. Such a material has been found to provide a friction surface member which effectively maintains stiffness when an automotive pedal assembly is tested over the necessary range of temperatures. Testing requires certain periods of operation at temperatures as extreme as -40°C and +90°C. A polypropylene copolymer would normally be expected to soften at high temperatures. However, the rubber-and-talc-modified polypropylene copolymer described above has been found to exhibit little operational variance during temperature testing of the pedal assembly.

For a user to depress the control pedal arm 60 from the rest position of Fig. 3, he must apply a force to the pedal arm which is sufficient to overcome the resilience of the springs 58a, 58b, and is also sufficient to overcome the frictional resistance provided by friction surfaces 52, 54, and any other friction inherent in the system. Frictional resistance is provided by friction surfaces 52, 54due to the contact force provided by springs 58a, 58b, which urge rotational movement of friction surface member 56 about its rotational mounting at axis A. The axis A may simply be provided, as illustrated, by a corner of a recess in which the friction surface member is located.

Fig. 4 shows the control pedal assembly in a fully depressed position. The springs 58a and 58b are compressed further, and apply a greater force to friction surface member 56. This greater force is balanced by a greater force applied to the control pedal arm by the user, to displace the pedal into the depressed position, which typically corresponds to a maximum vehicle speed or acceleration.

The increased force provided by the springs operates, by urging rotation of the friction surface member 56 about the axis A, to provide an increased force urging friction surfaces 52 and 54 into contact with each other. The increased force and the increased contact region 59' serve to increase the friction between the first and second friction surfaces, that is, the resistance to sliding motion over one another, or their resistance to displacement of the pedal control arm.

For the control pedal arm to move from the fully depressed position, the force applied to the control pedal arm by the user must be less than that required to overcome the force of springs 58a, 58b, by an amount sufficient to overcome the friction provided by friction surfaces 52, 54.

A degree of hysteresis is therefore provided, in that the minimum force which must be applied by the user to displace the pedal to the fully depressed position shown in Fig. 4 is greater than the maximum force which may be applied by the user, yet will allow the pedal to rise

from the fully depressed position, by an amount twice that required to overcome the friction provided by the interaction of friction surfaces 52, 54 (and any parasitic friction inherent in the system).

Consider an intermediate position of the control pedal arm, which lies between the rest position of Fig. 3 and the fully depressed position of Fig. 4. To displace the pedal from its rest position to such position, the user would have to apply a force sufficient to overcome the force of springs 58a, 58b, and the friction provided by the interaction of friction surfaces 52, 54 (and any other friction inherent in the system). To allow the pedal to rise from the intermediate position toward the rest position, the user would have to apply to the pedal a force less than equivalent to the force of springs 58a, 58b, by an amount required to overcome the effect of the friction provided by the interaction of friction surfaces 52, 54 (and any other friction inherent in the system). Therefore, hysteresis is provided at any position of the control pedal. The minimum force which must be applied by a user to displace the pedal to a given position is greater then the maximum force which may be applied by the user yet will allow the pedal to rise from the given position, by an amount equal to twice the effect of the friction surfaces 52, 54 (and any other friction inherent in the system). The range between the minimum applied force required to displace the pedal and the maximum applied force which will allow the pedal to rise will be called the hysteresis range.

By providing a significant amount of hysteresis in the displacement of the control pedal arm 60, the effect of bumps and shocks as discussed above is reduced.

Any bumps and shocks transmitted to the user's foot will not cause displacement of the pedal, provided that the force applied to the pedal taking the bumps and shocks into consideration lies within the hysteresis range caused by the friction providing part 50. If the force applied to the pedal, taking into the consideration the bumps and shocks, lies beyond the hysteresis range, then the control pedal will move, causing a variation in the speed of the vehicle. However, such displacement of the pedal and the consequent change in vehicle speed will be reduced by an amount equivalent to the effect of the friction providing part 50.

Although only one first friction surface 52, and one second friction surface 54, are illustrated in Figs. 2-4, a corresponding pair of friction surfaces are preferably symmetrically provided on the opposite side of the control pedal assembly. This arrangement will become clearer in the following description of Figs 5A-6B.

Fig. 5A shows a first perspective view of the friction surface member 56. Friction surface member 56 comprises a pivotally mountable cross piece 102, and a pair of arm pieces 104, 104', symmetrically provided at opposite sides of the cross piece 102, and extending parallel to one another in a direction perpendicular to the general plane of the cross piece 102. The overall shape of the

friction surface member may be described as a saddle. Each arm piece 104, 104' carries a corresponding friction surface 52 on its inwardly facing surface. In an alternative embodiment, the friction surfaces 52 could be formed on the outwardly facing surfaces. A projection 109 (not visible in Fig. 5A) is provided, suitably dimensioned and located to retain an end of the resilient member 58. A recess 106 is provided on each of the outwardly facing surfaces 104, 104', approximately corresponding to the location of first friction surfaces 52. A recess 108 is provided on the outwardly facing surface of cross piece 102, and generally conforms to the shape of projection 109. Recesses 106, 108 are preferably, but not necessarily, provided to allow the friction surface member 56 to be formed with a substantially constant wall thickness. Recesses 106 preferably do not fully extend to the extremities of the arm pieces, and the ends of such recesses 106 may be used as mechanical stops.

Fig. 5B shows a partially cut away, perspective view of friction surface member 56. Projection 109 is shown functioning to retain springs 58a, 58b in contact with the inwardly facing surface of cross piece 102. As can be seen from the cutaway part, each first friction surface 52 is supported upon a supporting piece 110, formed as an integral part of arm 104 and friction surface member 56. Recess 106 contributes to a substantially constant wall thickness of the arms 104, 104'.

Fig. 6A shows a perspective view of mounting bracket 70.

A second friction surface 54 is provided within each of a pair of cavities 120, 120' within the mounting bracket 70. A recess 121 and a projection 122 are provided, located between the cavities 120, 120', for retaining an end of the resilient member 58. When assembled, the arms 104, 104' are located within cavities 120, 120', and first friction surfaces 52 are rotatable into contact with second friction surfaces 54, by rotation of friction surface member 56 about its axis A (Fig. 2). A cavity 124 is provided, for retaining the position sensor means 80. A hole 126 is provided, centred on axis B. The sensor means 80 is preferably arranged such that, when located in recess 124, a hinge pin may be provided through hole 126, and a corresponding hole on the opposite side of recess 124, both to attach control pedal arm 60 to the mounting bracket 70, and to provide the axis of rotation B.

Preferably, the hinge pin also serves to connect the position sensor means 80 to the mounting bracket 70, and to connect it such that a sensing portion of the sensor means is displaced in accordance with displacement of the pedal 60 by rotation about the axis B.

Fig. 6B shows a cut away perspective view of a part of the mounting bracket 70. A projection 121' is visible, generally corresponding to the recess 121, to contribute towards a substantially uniform wall thickness of the mounting bracket 70. A recess may be provided in the surface of projection 121', to generally correspond to the projection 122, and to further contribute to a

uniform wall thickness of the mounting bracket 70. Second friction surfaces 54 are shown, located within cavities 120, 120' and provided on support parts 128. A cross support part 130 is provided, to increase the mechanical strength of support parts 128, and to keep them spaced apart by a required distance.

Fig. 7 shows a view of the rear of the friction producing part, including the part of the mounting bracket shown in Fig. 6B. Support parts 128 and cross support part 130 are illustrated. Second friction surfaces 54 are shown, and arc away into the plane of the drawing. Arms 104, 104' of friction surface member 56 are shown. First friction surfaces 52 are shown in contact with a part of each corresponding second friction surface 54. Notably, the first and second friction surfaces are inclined at a rake angle θ. The rake angle serves to urge arms 104, 104' into lateral contact with the support parts 128. The upper portions of arms 104, 104' prevent the first friction surfaces 52 from being laterally displaced from contact with second friction surfaces 54 in an inward direction. Rake angles θ, under the influence of an urging force due to resilient member 58 urging friction surface member 56 to rotate about axis A, prevent the first friction surfaces 52 from being laterally displaced from contact with second friction surfaces 54 in an outward direction.

The invention accordingly provides an improved control pedal assembly having reduced size, requiring less free space above the pivot. The position sensor can be changed

without disassembly of the control pedal assembly. In addition, the control pedal assembly of the invention should preferably be suitable for use with moulded plastic control pedals.

A control pedal assembly is provided, containing a reliable frictional hysteresis providing part. A frictional hysteresis function is simply and effectively provided. The parts required to make up the frictional hysteresis providing part occupy little space, and are simple and inexpensive to manufacture and assemble.

The friction produced increases with depression of the pedal, due to increased force from the resilient member 58, and increased contact surface area 59' between the friction surfaces 52, 54. This is advantageous in the field of vehicle speed control, as a greater resistance to bumps and shocks is provided when the vehicle is travelling at high speed.

Advantageously, in the described embodiment, should one of the springs 58a, 58b fail, then the friction produced by the frictional hysteresis providing part will reduce accordingly, as the friction provided depends on the strength of the spring(s) in use. This ensures that the frictional resistance provided by the hysteresis part does not exceed the spring bias, even when one of the springs is broken. Were this not the case, the control pedal would remain in its depressed position once the user had removed the applied force from the pedal. Such a situation would represent a dangerous loss of control of

the vehicle.

As the friction surface member is pivotally mounted, any wear of the friction surfaces which may occur after a long period of use is compensated for automatically by rotation of the friction surface member under the influence of resilient member 58. From consideration of the illustrated embodiments, a significant amount of wear of the friction may be compensated for by only a small angular rotation of the friction surface member, and attendant drop in the urging force of the resilient member.

By providing a pivotally mounted friction surface member carrying one of the friction surfaces, the invention provides a friction producing part which is reliable, which automatically compensates for wear of the friction surfaces and which may be simply assembled and dismantled. All parts of the control pedal assembly may preferably be constructed from injection moulded plastics materials, with the exception of springs or other resilient member 58 and any sensor means employed.

Although the present invention has been described with reference to a certain number of particular embodiments, many variations and modifications of the invention will be apparent to one skilled in the art, and lie within the scope of the invention. For example, the pivotally mounted friction surface member may be mounted on either the pedal arm or the mounting bracket. More or less than two arms, and corresponding friction surfaces, may be

provided. More than one friction surface may be provided on each arm, with corresponding co-operating friction surfaces being provided. The control pedal assembly of the present invention may be adapted for control by an operator's hand, or otherwise, and the term 'pedal' should be understood accordingly. Although described with reference to control pedals for vehicles, the invention may advantageously be applied to other control pedals, for example, control means for industrial machinery, aircraft, electronic games, or musical instruments. Furthermore, the invention may be applied to vehicle steering controls where a symmetrical arrangement of frictional hysteresis providing parts may be provided, with spring bias acting to return the steering control to a 'straight ahead' rest position. Pedal assemblies according to the invention do not necessarily have pedal arms which rotate about the axis. Linear pedal control assemblies could be provided with a frictional hysteresis providing part according to the present invention.

CLAIMS:

1. A control pedal assembly including a frictional hysteresis providing part, which comprises:

- a first friction surface mechanically linked to a control pedal arm;

- a second friction surface mechanically linked to a mounting bracket of the control pedal assembly;

- a pivotally mounted friction surface member carrying one of the friction surfaces; and

- a resilient member pivotally biasing the friction surface member about an axis, so as to resiliently bias the first and second friction surfaces into mutual contact.

2. A control pedal assembly according to claim 1 wherein the friction surface member comprises:

- a pivotally mountable cross piece;

- at least one arm piece carrying a corresponding friction surface and extending in a direction perpendicular to the general plane of the cross piece,

the friction surface member being pivotally mounted about an axis substantially perpendicular to the direction of the arm(s).

3. A control pedal assembly according to claim 2 wherein the pivotal axis of the friction surface member is also substantially perpendicular to a plane of displacement of the control pedal arm.

4. A control pedal assembly according to any preceding

claim wherein the friction surface member is mechanically linked at its axis to the control pedal arm.

5. A control pedal assembly according to claim 4 wherein the resilient member acts upon the control pedal arm through the friction surface member, and through its axis, to urge the pedal into a rest position.

6. A control pedal assembly according to any preceding claim wherein the pivotal bias applied by the resilient member increases with the depression of the pedal control arm.

7. A control pedal assembly according to any preceding claim wherein each of first and second friction surfaces comprises a pair of substantially arcuate surfaces, centred on an axis of rotation of the control pedal arm, each pair of substantially arcuate surfaces located one on either side of the resilient member.

8. A control pedal assembly according to any preceding claim wherein the first and second friction surfaces are arranged to remain biased into mutual contact throughout a range of travel of the pedal control arm.

9. A control pedal assembly according to any preceding claim wherein the friction surface member is integrally formed with the associated friction surface, as a plastic moulding.

10. A control pedal assembly according to any preceding

claim wherein the first friction surface is integrally formed with the control pedal arm, as a plastic moulding.

11. A control pedal assembly according to any preceding claim wherein the second friction surface is integrally formed with the mounting bracket, as a plastic moulding.

12. A control pedal assembly according to any preceding claim wherein at least one of the friction surfaces is constructed of glass filled nylon.

13. A control pedal assembly according to any preceding claim wherein at least one of the friction surfaces is constructed of a rubber-and-talc-modified polypropylene copolymer.

14. A control pedal assembly comprising at least one friction surface constructed of a rubber-and-talc-modified polypropylene copolymer.

15. A control pedal assembly according to claim 13 or claim 14 wherein the rubber-and-talc-modified polypropylene copolymer comprises 10-40% by weight of talc.

16. A control pedal assembly according to claim 15 wherein the rubber-and-talc-modified polypropylene copolymer comprises 20-30% by weight of talc.

17. A control pedal assembly substantially as described and/or as shown in Figs 2 - 7 of the accompanying

drawings.

18. Use of a rubber-and-talc-modified polypropylene copolymer as a friction surface in a control pedal assembly.

19. Use, according to claim 18, in a control pedal assembly according to any of claims 1-17.

20. Use, according to claim 18 or claim 19, of a rubber-and-talc-modified polypropylene copolymer containing 10-40% talc, by weight.

21. Use, according to claim 20, of a rubber-and-talc-modified polypropylene copolymer containing 20-30% talc, by weight.

22. Use of a rubber-and-talc-modified polypropylene copolymer substantially as described.

23. A component carrying a friction surface, for use in a control pedal assembly, the friction surface being composed of a rubber-and-talc-modified polypropylene copolymer.

24. A component according to claim 23 wherein the rubber-and-talc-modified polypropylene copolymer contains 10-40% talc, by weight.

25. A component according to claim 24 wherein the rubber-and-talc-modified polypropylene copolymer contains

20-30% talc, by weight.

26. A component carrying a friction surface, for use in a control pedal assembly, the component being substantially as described and/or as shown in Figs 2 - 7 of the accompanying drawings.

Abstract

A CONTROL PEDAL ASSEMBLY

A control pedal assembly including a frictional hysteresis providing part comprises a first friction surface mechanically linked to a control pedal arm; a second friction surface mechanically linked to a mounting bracket of the control pedal assembly; a friction surface member carrying one of the friction surfaces; and a resilient member biasing the first and second friction surfaces into mutual contact.

(Fig. 2)

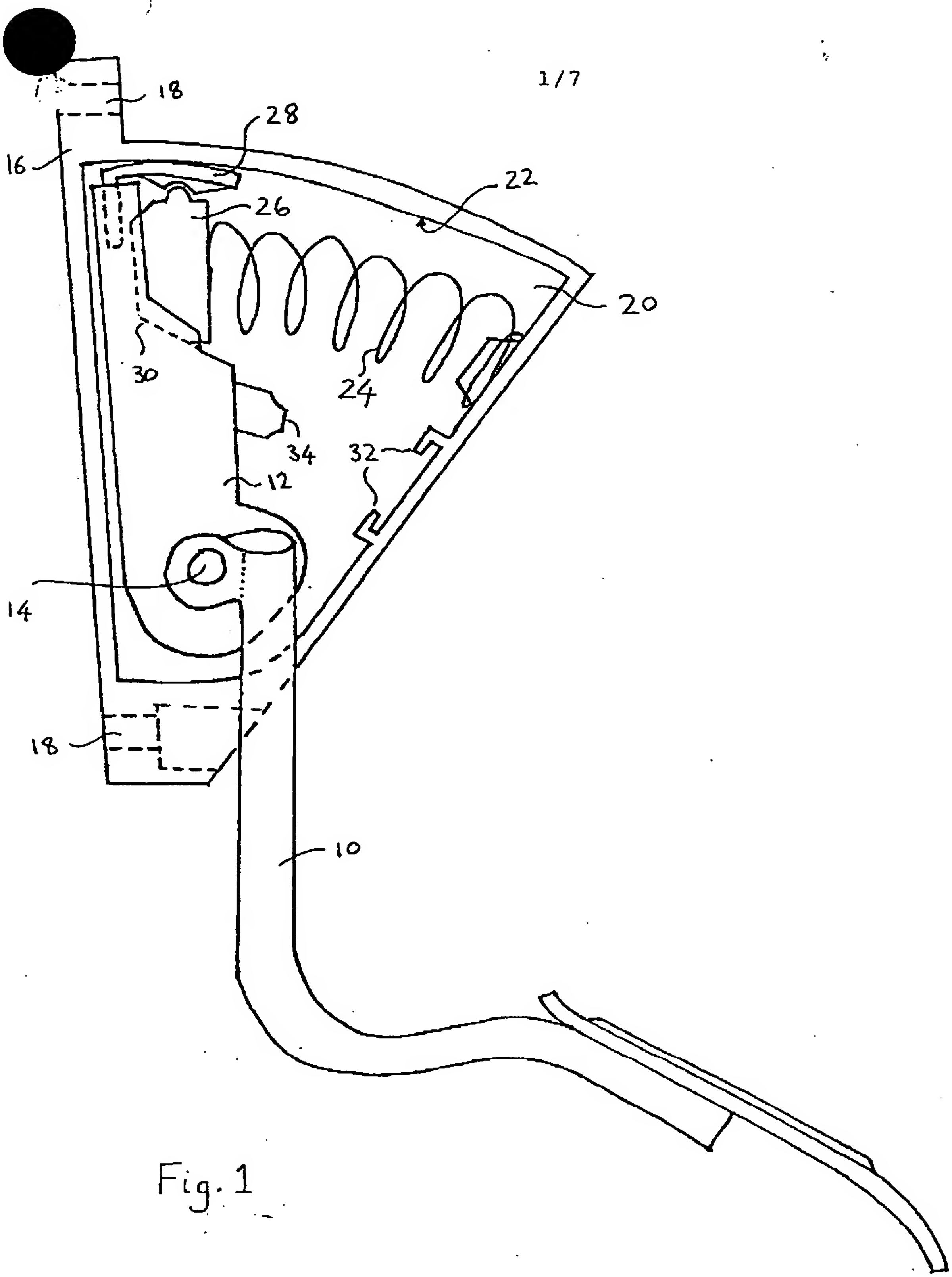

Fig. 1

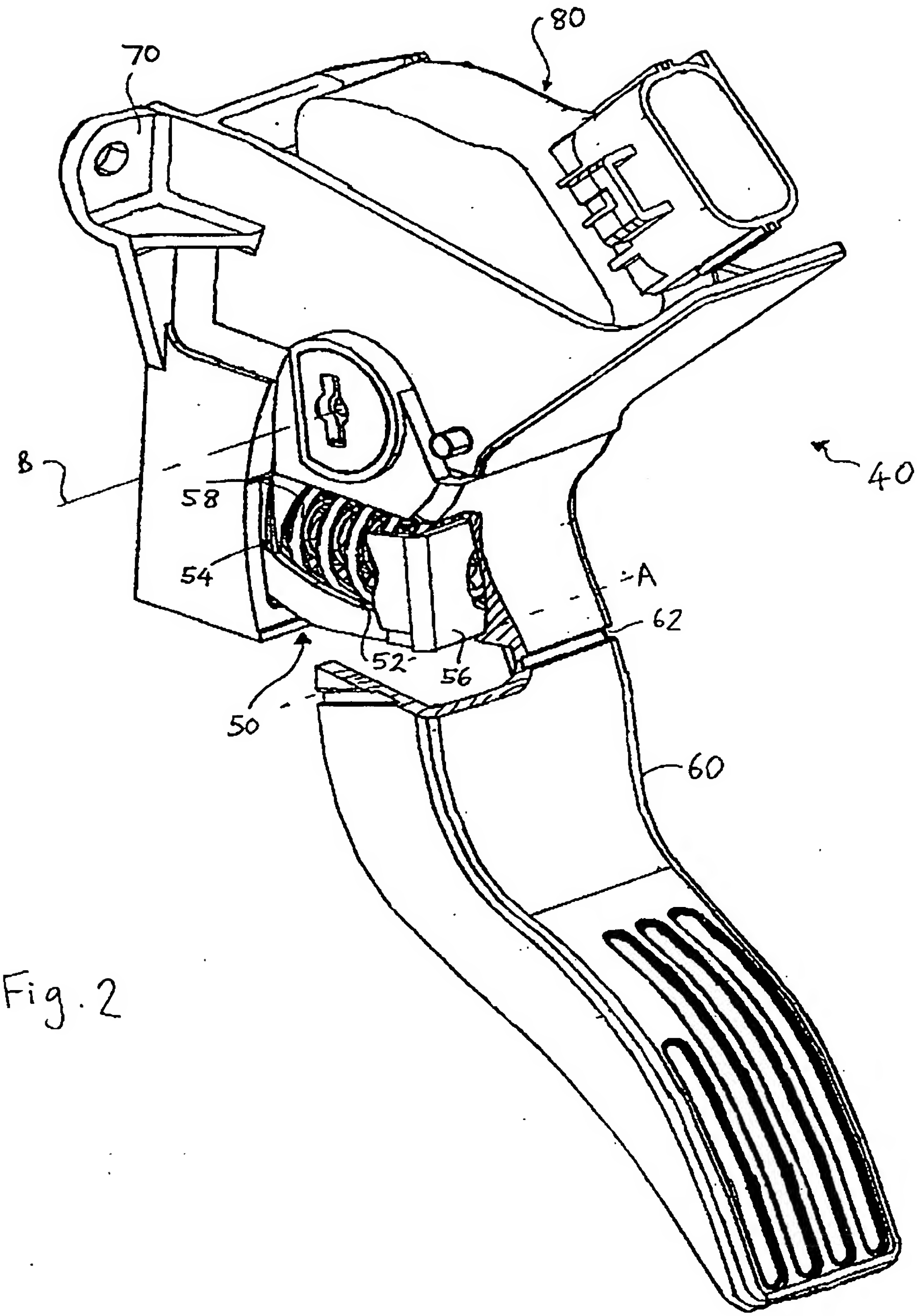

Fig.2

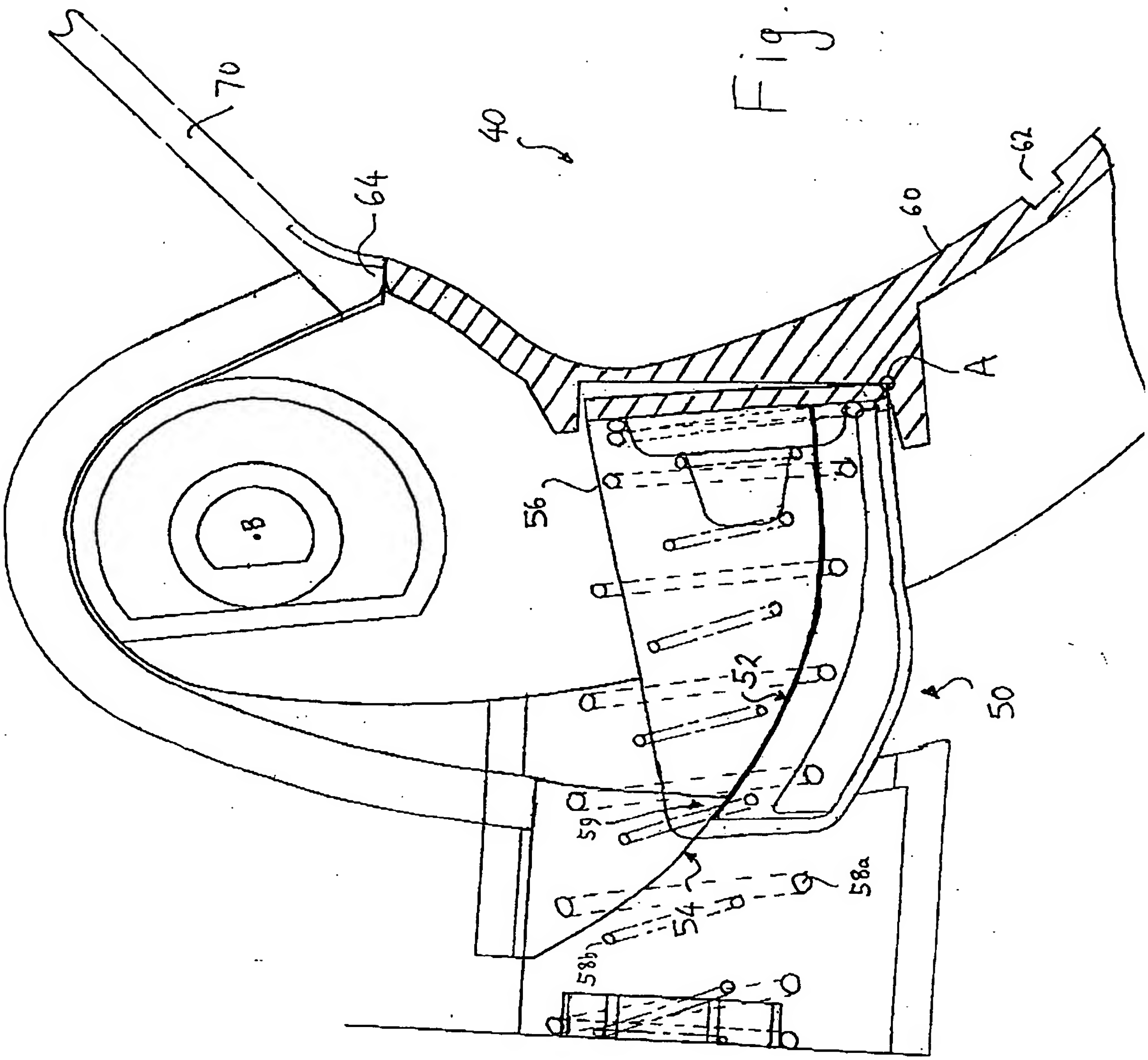

Fig. 3

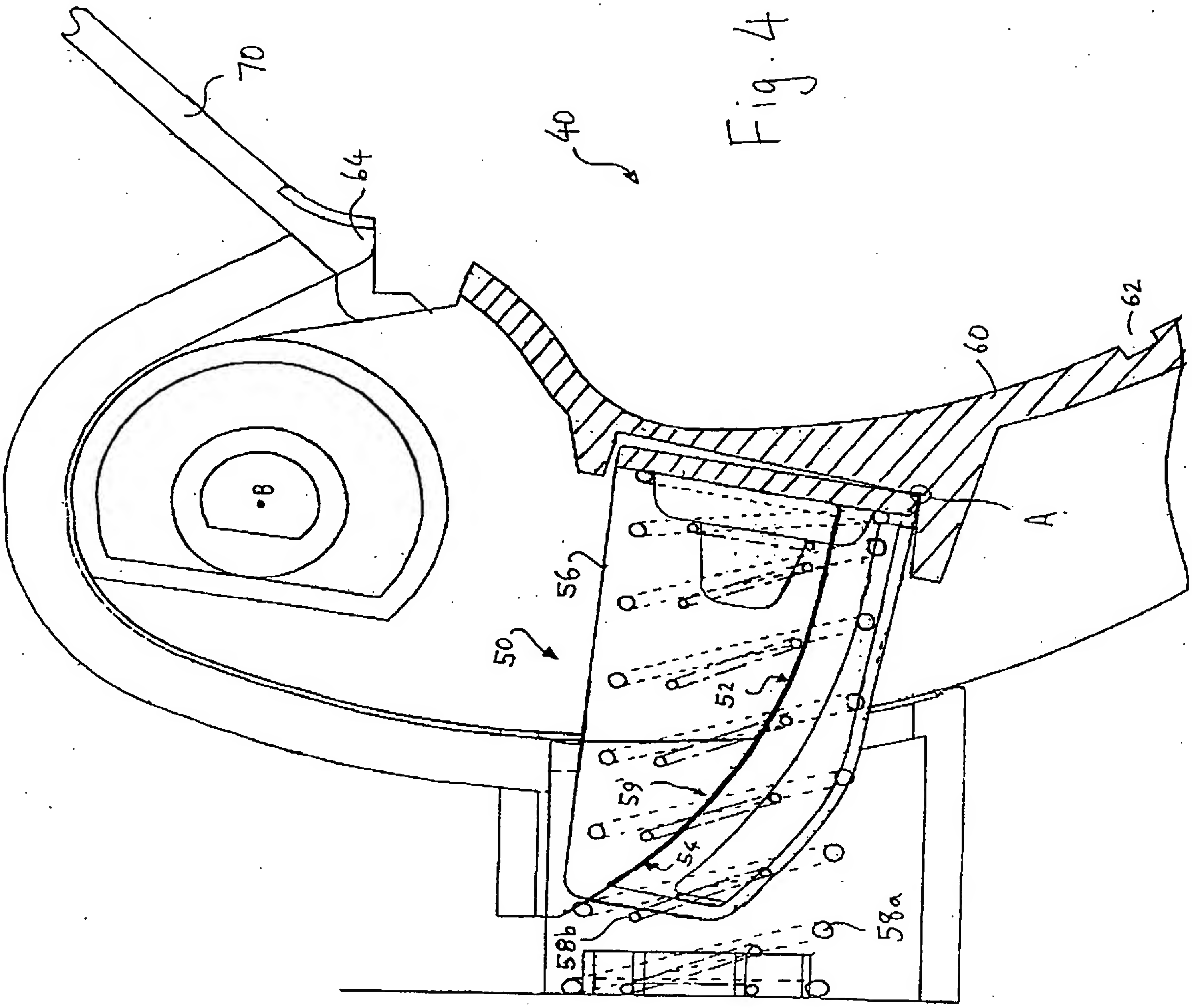

Fig. 4

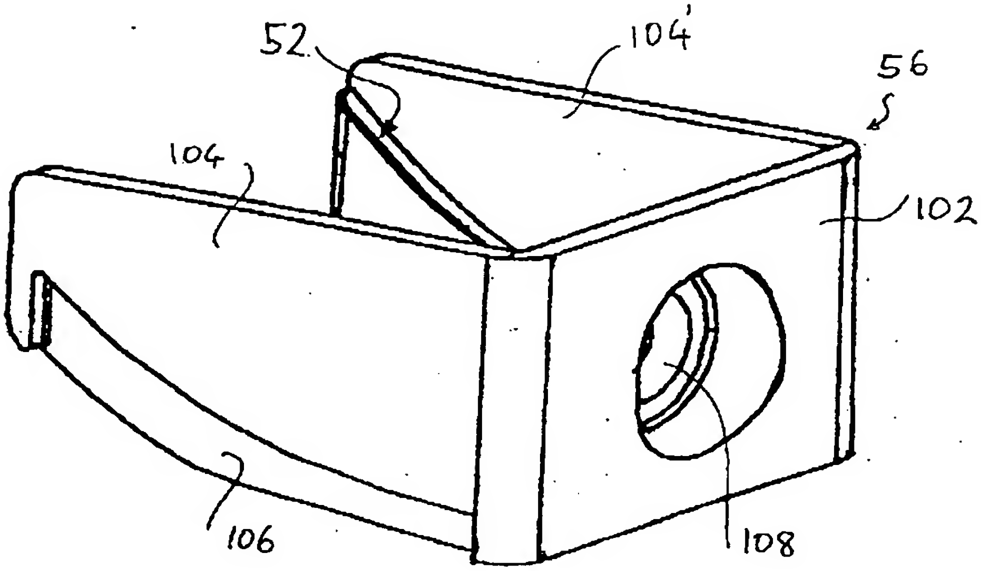

Fig.5 A

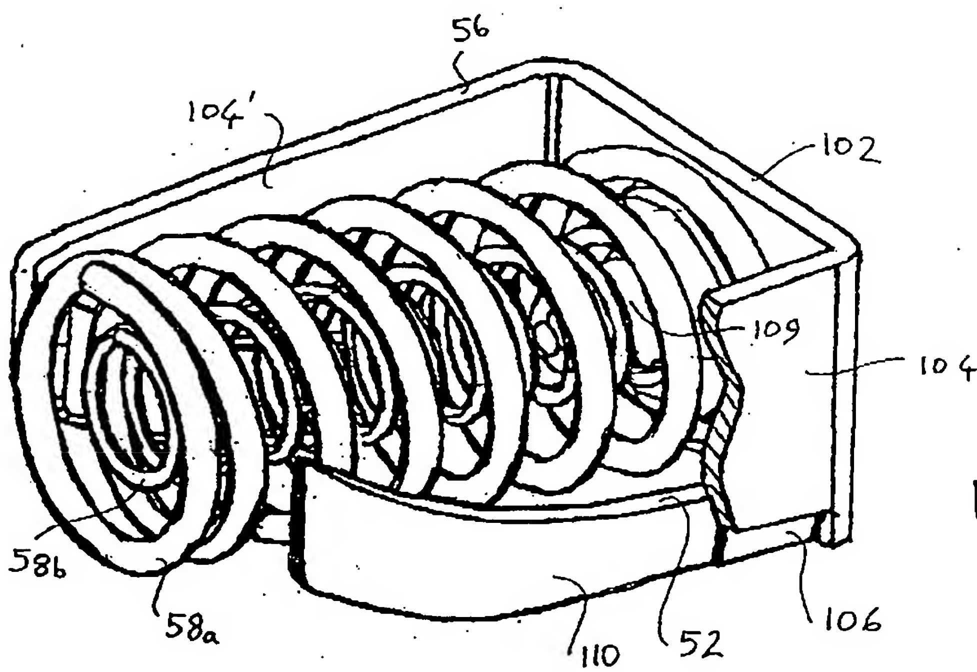

Fig.5 B

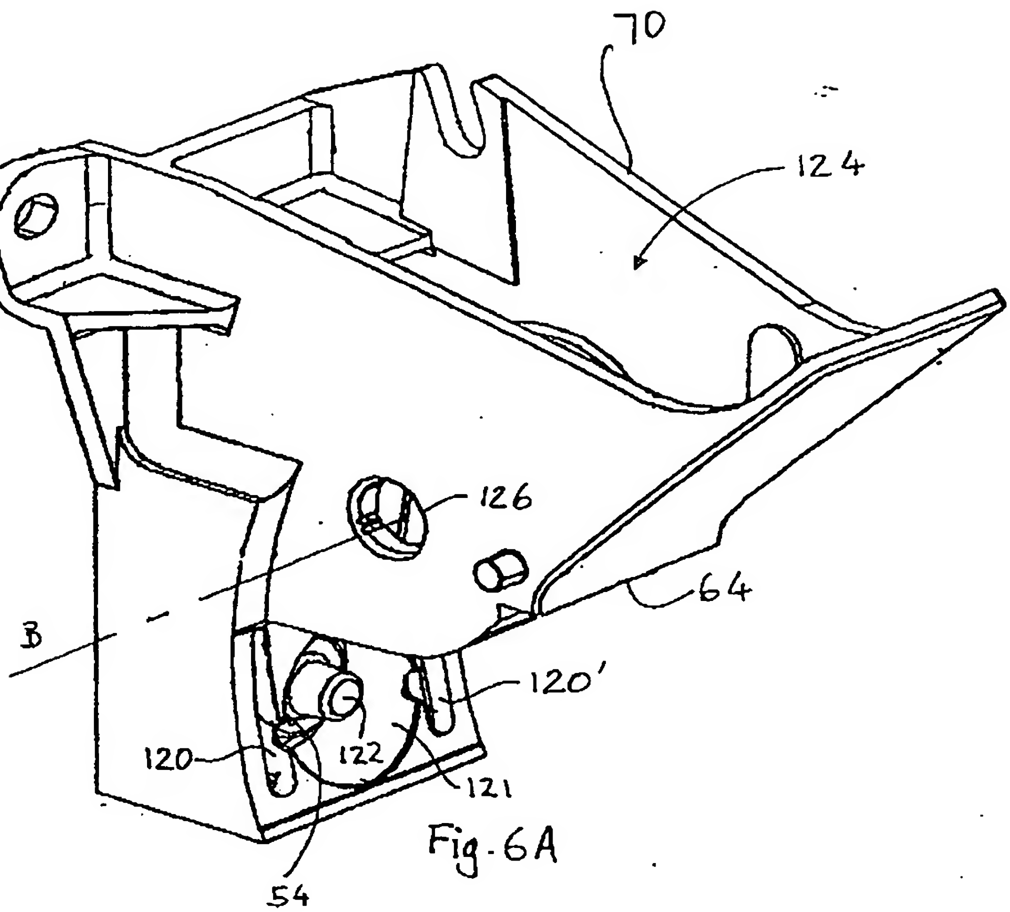

Fig. 6A

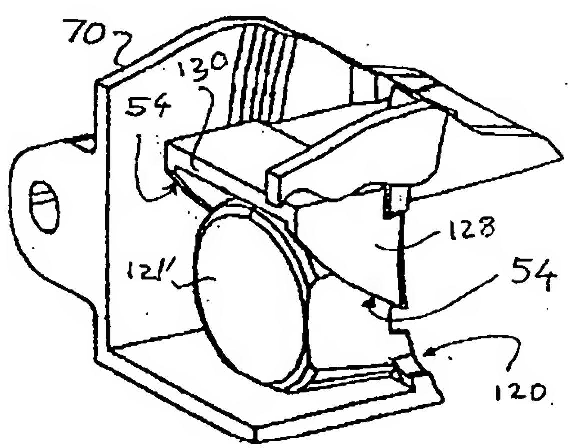

Fig. 6B

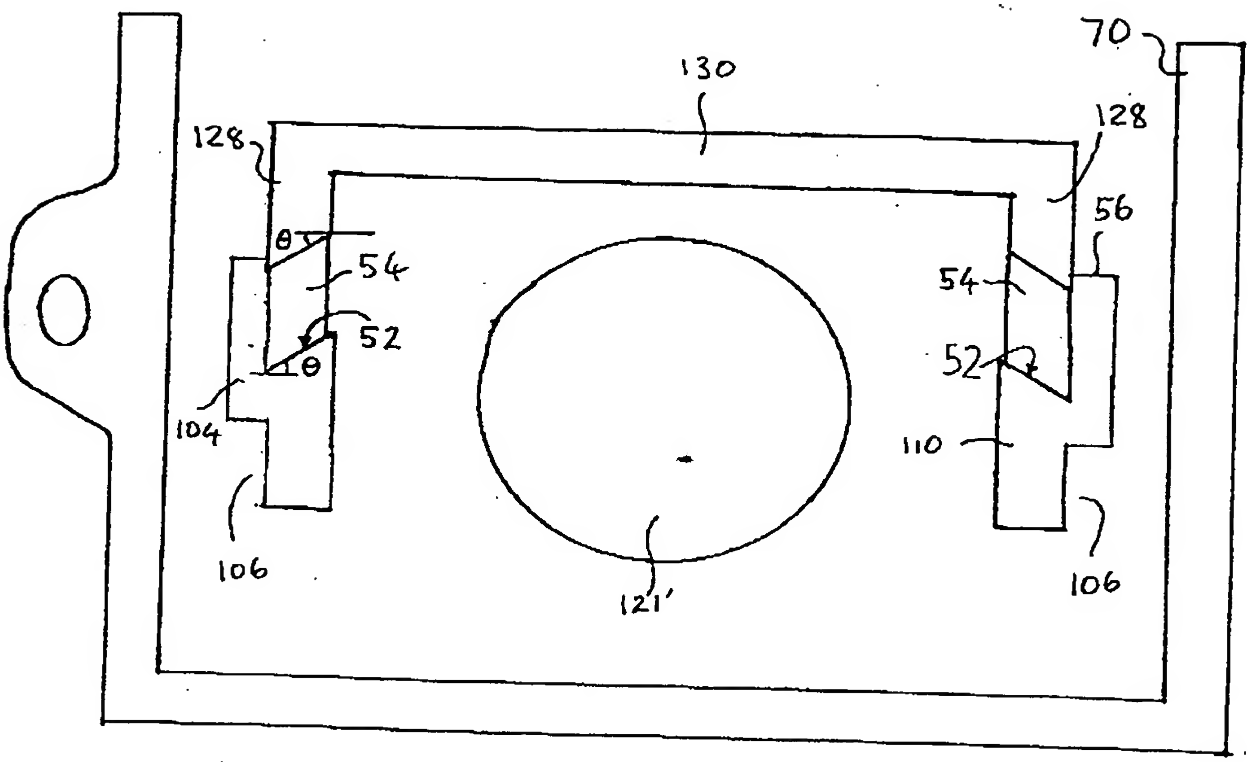

Fig. 7

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